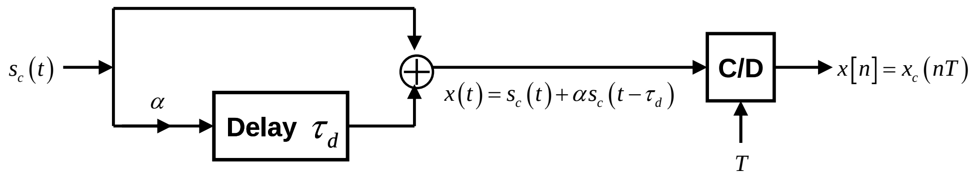
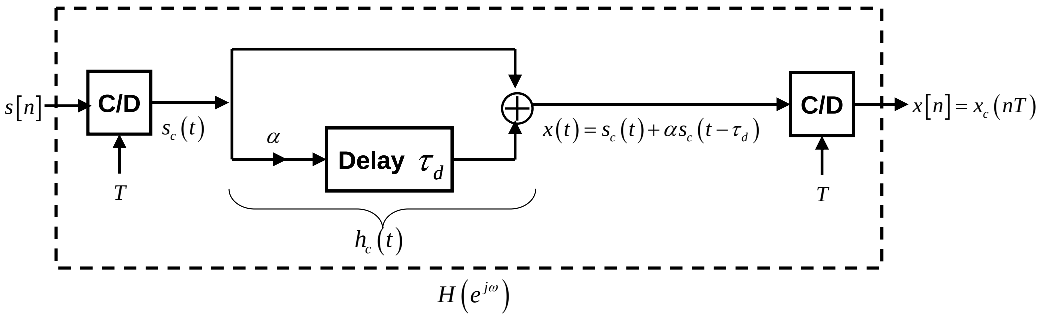
(a)



$$X_c(j\Omega)=\Im\{s_c(t)+\alpha s_c(t-\tau_d)\}=S_c(j\Omega)\left(1+\alpha e^{-j\Omega\tau_d}\right).$$

$$X(e^{j\omega})=\frac{1}{T}\sum_{k=-\infty}^{\infty}X_c\left(j\left(\frac{\omega}{T}+\frac{2\pi k}{T}\right)\right)=\frac{1}{T}\sum_{k=-\infty}^{\infty}\left[S_c\left(j\left(\frac{\omega}{T}+\frac{2\pi k}{T}\right)\right)\left(1+\alpha e^{-j\left(\frac{\omega}{T}+\frac{2\pi k}{T}\right)\tau_d}\right)\right].$$

(b)



$$H_c(j\Omega)=\Im\{h_c(t)\}=\begin{cases}1+e^{-j\Omega\tau_d} & ,|\Omega|\le\frac{\pi}{T}\\ 0 & ,otherwise.\end{cases}$$

By (4.60) and $\omega=\Omega T$, $H(e^{j\omega})=H_c\left(j\frac{\omega}{T}\right)=1+\alpha e^{-j\frac{\omega\tau_d}{T}}$.

(c)

(i) $\tau_d=T$

$$H(e^{j\omega})=1+\alpha e^{-j\omega}\Rightarrow h[n]=\delta[n]+\alpha\delta[n-1].$$

(ii) $\tau_d=\frac{T}{2}$

$$H(e^{j\omega})=1+\alpha e^{-j\frac{\omega}{2}}\Rightarrow h[n]=\frac{1}{2\pi}\int_{-\pi}^{\pi}\left(1+\alpha e^{-j\frac{\omega}{2}}\right)e^{j\omega n}d\omega=\delta[n]+\alpha\frac{\sin[\pi(n-1)]}{\pi(n-1)}.$$